

Impact of COVID-19 pandemic on spontaneous pneumothorax

Pneumothorax during COVID-19

Murat Sarıçam¹, Oya Güven²¹ Department of Thoracic Surgery² Department of Emergency Medicine, Faculty of Medicine, Kırklareli University, Kırklareli, Turkey**Abstract**

Aim: Deterioration of lung parenchyma due to COVID-19 infection is considered to be responsible for the development of spontaneous pneumothorax (SP). This study aimed to compare the clinical and epidemiological features of SP diagnosed in pre-pandemic and pandemic periods.

Material and Methods: Patients who developed SP before and during the pandemic were comparatively analyzed in terms of age, gender, side of SP, type of initial treatment such as observation or chest tube insertion, requirement of additional surgery and duration of hospital stay.

Results: Cases who encountered SP in the pandemic were older, required chest tubes at admission to the hospital more frequently, and stayed longer. Moreover, patients infected with COVID-19 received a higher number of subsequent surgical interventions.

Discussion: Timely interventions and careful follow-up are critical to overcome the potential complications and mortality from developing SP during the COVID-19 pandemic.

Keywords

COVID-19, Spontaneous Pneumothorax, Pandemic

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Corresponding Author: Oya Güven, Department of Emergency Medicine, Faculty of Medicine, Kırklareli University, Kırklareli, Turkey.

E-mail: ersinoya@yahoo.com P: +90 506 860 46 35

Corresponding Author ORCID ID: <https://orcid.org/0000-0002-6389-4561>

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Introduction

COVID-19 (SARS-CoV-2) is a zoonotic virus first identified in Wuhan City, China, in December 2019 [1]. Despite vaccine and antiviral treatment strategies, prognosis has been poor in some patients originating mostly from respiratory complications [1,2]. Recent studies have reported that pneumothorax might be present in 1% of patients who had required hospital admission, and the rate of both pneumothorax and pneumomediastinum was as high as 15% in mechanically ventilated cases [1-3]. Spontaneous pneumothorax (SP) is the accumulation of air in the pleural space due to causes exclusive of any traumatic and iatrogenic events. It has been described in some previously published case series as a complication of COVID-19-related severe acute respiratory syndrome comprising serious lung injury with an incidence of up to 1.7% in hospitalized patients [2-4].

Here, we report two series of SP, including pre-pandemic and pandemic periods. Our study aims to comparatively present the clinical and epidemiological features of the patients in both time intervals and investigate the potential differences in COVID-19 infected cases in terms of prognosis and courses of treatment.

Material and Methods

This research was approved by the Faculty of Medical Ethics Committee (P202200011-02/7.4.22) and the Ministry of Health COVID-19 study platform (2022-02-20T18_48_17).

This study was conducted to investigate the potential effects of the COVID-19 pandemic on the development and course of SP. Fifty cases diagnosed with SP were randomly selected for pre-pandemic and pandemic periods, which were confined from November 2013 to February 2016 and March 2021 to March 2022, respectively. Cases with any sign of recent chest trauma or a past history of pneumothorax were excluded from the study. Moreover, patients who developed SP during the course of non-invasive or invasive mechanical respiratory support were not included in the study. COVID-19 infection has been approved as positive through a radiological examination and/or polymerase chain reaction (PCR) swab.

The same thoracic surgeon observed all cases, performed tube thoracostomies and performed further surgeries, all for patients with air leakage lasting more than 5 days or insufficient lung expansion. Bullectomy or wedge resection combined with partial parietal pleurectomy via axillary mini-thoracotomy was performed when required. During the pandemic, the whole group of COVID-19 patients with SP was admitted to the level 1 intensive care unit, and the follow-up was assisted by anesthesiologists and infectious diseases physicians.

All patients were investigated in terms of age, gender, side of SP, type of initial treatment as observation or chest tube insertion, the requirement of additional surgery and duration of hospital stay. Comparative analysis was applied to reveal the differences regarding the potential impact of COVID-19 infection.

SPSS (IBM SPSS for Windows, ver.24) statistical package program was used for calculations. Descriptive statistics for continuous variables in the study were expressed as mean and standard deviation; categorical variables were expressed as

number (n) and percentage (%). Independent Samples-T test was used to compare the averages of measurements, and the Chi-square test was employed to reveal the relationship between categorical variables. P-value <0.05 was used to indicate the statistical significance.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

Mean age was 37.2 (range: 17-87) years among a total of 84 (84%) male and 16 (16%) female patients. Pneumothorax was diagnosed on the right side in 60 (60%) cases, and chest tube insertion was necessary for 84 and additional surgery for 19 patients. The mean length of in-hospital stay was 4.80 (range: 2-22) days, whereas 20 cases were diagnosed with COVID-19. Details are given in Table 1.

In comparison, the mean age was 31.1 years, and the duration of hospital stay was 3.94 days for the patients in the pre-COVID period, while these values were 43.3 years and 5.66 days for the COVID period, respectively. However, both groups did not demonstrate significant differences when examined in terms of gender, side of pneumothorax and requirement for further surgery, but cases in the COVID group underwent tube thoracostomy in larger measures. A comparison of the two periods is detailed in Table 2.

When comparing the pandemic period, cases infected and not infected with COVID-19 exhibited little diversity in demographic and clinical characteristics. Among a total of 20 COVID-positive patients, including 18 (90%) males, the mean age was 48.6 years, whereas pneumothoraxes were right-sided in 13, chest tubes were inserted in 19, additional surgeries were performed in 11 cases. Moreover, the duration of in-hospital stay was significantly longer in this group. Related data are shown in Table 3.

In summary, patients who developed SP in the pandemic demonstrated older ages, required chest tubes as the first option of initial treatment more frequently and stayed at the hospital for longer periods. Moreover, COVID-19 infected cases required a higher number of additional surgical interventions and longer hospital stays compared to disease-free individuals. None of the patients encountered mortality or morbidity. Six of 11 COVID-19 patients who underwent additional surgery during the pandemic needed short-term home oxygen support after discharge.

Some examples of X-ray and computerized tomography (CT) images concerning SP in COVID-19 cases are given in Figure 1.

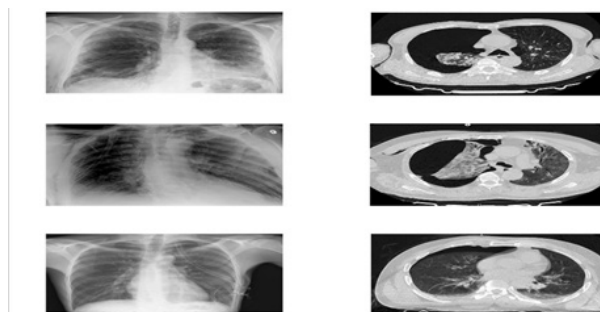


Figure 1. Radiological findings of pneumothorax in COVID-19 patients. The X-ray image is in the left column, and CT is demonstrated in the right column.

Table 1. Characteristics of the general patient group.

Variables		Mean±SD (Range)
Age (years)		37.2±18.3 (17-87)
Hospital stays (days)		4.80±2.81 (2-22)
Variables		N (%)
Gender	Male	84 (84)
	Female	16 (16)
Side of pneumothorax	Right	60 (60)
	Left	40 (40)
Initial treatment	Observation	16 (16)
	Chest tube	84 (84)
Additional surgery	Yes	19 (19)
	No	81 (81)
COVID-19	Negative	80 (80)
	Positive	20 (20)

SD: Standard deviation, N: Number, %: Percentage

Table 2. Comparison of pre-pandemic and pandemic periods.

Variables	Pre-Pandemic Period	Pandemic Period	P-Value
Age, mean±SD (range), years	31.1±13.5 (18-87)	43.3±20.4 (17-77)	<0.001
Gender, n	Male	41	0.585
	Female	9	
Side of pneumothorax, n	Right	29	0.683
	Left	21	
Initial treatment, n	Observation	12	0.029
	Chest tube	38	
Additional surgery, n	Yes	7	0.202
	No	43	
Hospital stay, mean±SD (range), days	3.94±1.73 (2-12)	5.66±3.39 (2-22)	0.002

Table 3. Features of patients in the pandemic period related to COVID-19 infection.

Variables	COVID-19 Negative Patients (n:30)	COVID-19 Positive Patients (n:20)	P-value
Age, mean±SD (range), years	39.8±19.1 (17-77)	48.6±21.6 (19-77)	0.714
Gender, n	Male	25	0.506
	Female	5	
Side of pneumothorax, n	Right	18	0.721
	Left	12	
Initial treatment, n	Observation	3	0.523
	Chest tube	27	
Additional surgery, n	No	29	<0.001
	Yes	1	
Hospital stay, mean±SD (range), days	3.77±1.10 (3-8)	8.50±3.69 (5-22)	<0.001

Discussion

The findings of this study clearly show that patients who developed SP during the pandemic showed distinctive clinical features such as older age or prolonged hospital stay and mainly required more challenging treatment courses to recover. The same as the well-recognized SP, COVID-19 patients have been reported to develop clinical manifestations, including chest pain, dyspnea, and inability to breathe deeply, but also radiological findings such as a linear shadow of the visceral pleura with lack of lung markings indicating collapsed lung [5,6]. Principal causes of pneumothorax in the patients with COVID-19 who did not receive mechanical ventilation were listed as alveolar damage and rupture due to pneumonia damaging the structure of lung parenchyma with inflammatory changes and comprising cystic formations and alveolar septal thickenings [6-9].

Regarding the current literature, consisting of limited case series or studies focusing on the risk factors for the development and the prognosis of SP in intubated patients with COVID-19, we were unable to compare our findings [8, 10-13].

In comparison, patients who developed SP during the pandemic were older and more frequently required chest tube drainage due to the size of the pneumothorax and their clinical conditions. Moreover, their hospital stay was longer as a consequence of prolonged air leakage and duration of treatment. Cases with Covid-19 also underwent curative surgery more often when compared to non-COVID patients.

The development of pneumothorax has been suggested as an important prognostic marker during coronavirus infection regarding the additively arising comorbidities and complications [5, 9]. Although mortality rates have been reported to be up to 70% by some earlier published studies, including a very limited number of cases, none of our patients encountered death [8, 13, 14]. This outcome may be due to timely interventions and attentive follow-up.

The strength of this study comes from the significant number of cases included since our hospital is the largest healthcare provider, including the only thoracic surgeon in the city. Principle limitation may be noted as the retrospective and single-centered design. Moreover, strict boundaries were prescribed to present the clinical and surgical features of the patients more accurately.

Patients who develop spontaneous pneumothorax during COVID-19 infection require chest drainage and additional surgeries more frequently, resulting in prolonged hospital stays. Appropriate interventions and careful follow-up of patients are critical to prevent mortality.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

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